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AN INTEGRATIVE MODEL OF INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) KNOWLEDGE DIFFUSION IN THE MULTINATIONAL ENTERPRISE

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ABSTRACT

This paper tests empirically the effectiveness of information and communications technology (ICT) knowledge transfer and adoption in the multinational enterprise. The research supports the proposition that absorptive capacity and perceptions of procedural fairness jointly determine such effectiveness, especially in cases of high tacit knowledge transfers. We collected data from senior ICT representatives from eighty-six Canadian subsidiaries of foreign owned firms that have recently experienced significant ICT transfers from abroad, mandated by the parent organization. The perceived success of the ICT knowledge transfer as well as the ICT adoption has varied widely across these firms. Our findings suggest that in a situation of substantial knowledge tacitness, the combination of high levels of absorptive capacity and procedural fairness is critical to effective knowledge transfer and ICT adoption. We find that higher levels of procedural justice reinforce the positive impact of higher levels of absorptive capacity. ICT projects do vary in the level of tacit knowledge that needs to be transferred, and in the presence of high tacit knowledge we find a stronger positive impact of procedural justice.

Keywords: tacit knowledge, diffusion, ICT, adoption, multi national, absorptive capacity, procedural justice

INTRODUCTION

This paper presents the results from research on the effectiveness of information and communications technology (ICT) knowledge transfer and adoption in the multinational enterprise (MNE). Many MNEs rely on information and communication technology (ICT) transfers to achieve scope economies, and thus superior economic performance. Common ICT systems are a critical facilitator of knowledge sharing across value chain activities, and thus, potentially constitute a non-location bound firm-specific advantage (FSA) for the MNE, much in line with Dunning and Rugman's (1985) description of transactional (as opposed to asset-based) advantages, related primarily to the coordination and control of international operations. If common ICT systems are a prime conduit for the subsequent, easy intra-MNE sharing of non-location bound knowledge, and therefore instrumental to scope economies, it is important to study their transfer to - and adoption by - the MNE's foreign subsidiaries.

The need for trading off scale efficiencies (standardization) and effectiveness in local implementation (adaptation) when transferring knowledge inside the MNE is relatively well understood, and much literature has focused on achieving the required levels of national and regional responsiveness (Rugman, 1996 2005). However, our work we believe is the first to combine insights on absorptive capacity (Cohen & Levinthal, 1990; Szulanski, 1996; Zahra & George, 2002) and procedural justice (Kim & Mauborgne, 1991) in the context of ICT knowledge transfer and adoption, so as to understand how effectiveness is achieved when standardization is imposed by the parent company and local adaptation of the ICT system transferred is quasi non-existent, precisely to guarantee the creation of a transactional FSA benefiting the entire MNE network (Dunning & Rugman, 1985).

In the next section we discuss the concepts of absorptive capacity, procedural justice, and knowledge tacitness, and develop the hypotheses relating these parameters to achieving effectiveness in knowledge transfer and ICT adoption. The third section presents the research methodology and examines the measurement of the constructs. The fourth section reports the findings and the paper concludes with a discussion of this research's implications for management.

THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

Firms differ in their level of preparedness and capabilities to understand and apply new knowledge. This concept of absorptive capacity is the ability of the firm to recognize the value of outside sources of knowledge, to assimilate that knowledge into the organization, and to exploit that knowledge for commercial gain (Cohen & Levinthal, 1990). This ability is a function of both the prevailing communication system and the level of prior related knowledge. The communication system and prior knowledge are idiosyncratic to the firm and potentially constitute a firm specific advantage (FSA), and therefore a source of competitive advantage. One example of this concept's relevance in the international context is Kedia and Bhagat's (1988) conceptual model of technology transfer across nations. This model suggests the efficacy of technology transfer across nations is affected by the "organizational culture-based differences and specific characteristics of the technology involved" and "moderated by variations in societal culture-based differences and receptivity to technological change in terms of the absorptive capacity of the recipient organization" (Kedia and Bhagat's 1988: 561).

The above analysis suggests that, when faced with a parent company mandated ICT transfer, a high level of absorptive capacity at the subsidiary level, irrespective of knowledge characteristics, will facilitate ICT knowledge transfer. This greater ability to recognize, assimilate and exploit knowledge would be expected to lead to higher performance outcomes thereby improving the effectiveness of the ICT adoption. This leads to the hypothesis that:

H1: Higher absorptive capacity of the MNE subsidiary leads to more effective ICT knowledge transfer and adoption.

The adoption of ICT systems at the subsidiary-level is often imposed and their use mandated by the parent company for reasons outlined above (Gallivan, 2001). When faced with a lack of national responsiveness by the parent, subsidiary managers may then still react positively to the ICT transfers imposed on them, provided they perceive the decision-making process as fair. This procedural justice concept assumes that people's reaction to a decision is partially dependent on the procedures used to

arrive at that decision. Procedural justice perceptions have been shown to have positive effects on higher-order attitudes of commitment, trust, and social harmony, and lower-order attitudes of outcome satisfaction in organizations whose members are subject to hierarchical decision-making processes (Kim & Mauborgne, 1991).

Kim and Mauborgne (1991) generated and tested the criteria relevant to procedural justice in international management decision-making. The insightful research suggests five characteristics of procedural justice: (1) bilateral communications, (2) consistent, non-discriminatory decision-making procedures, (3) challenging and refuting views of corporate headquarters, (4) full accounting of final decisions, and (5) familiarity of the local situation by corporate headquarters. These five characteristics of procedural justice are not only important to resource allocation decisions, but can also be used to examine ICT transfers from the perspective of the subsidiary. Procedural justice is particularly important in the ICT context, because subsidiaries will not just experience procedural justice (or the lack thereof) during the actual ICT transfer process, but also during all the subsequent knowledge diffusion processes that may use the ICT-system as a transfer conduit.

Perceptions of procedural fairness create an environment conducive to knowledge sharing that increases the likelihood of a successful outcome. We expect that higher procedural fairness as perceived by the subsidiary will have a positive significant impact on ICT knowledge transfer and adoption effectiveness. This leads to the hypothesis that:

H2: Higher procedural justice perceived by the MNE subsidiary reinforces the positive impact of absorptive capacity on effective ICT knowledge transfer and adoption.

The structure of an MNE is often complex and the firm's strategic orientation can have a significant impact on knowledge diffusion. The strategic orientation of a firm that crosses national borders can be categorized according to the 'global', 'international', and 'multinational' archetypes, and the 'transnational' form, which is a synthesis of the three archetypes (Bartlett & Ghoshal, 1991). Each of these different strategic orientations has a corresponding ICT system configuration (Ferguson & Khandelwal, 2000). The measures of organizational structure viewed as most critical to knowledge

transfers are the unit's autonomy and the level of interunit integration (Birkinshaw, Nobel, & Ridderstråle, 2002; Kostova & Roth, 2002). Autonomy or decentralization is the ability of a unit to make decisions independently of the corporate headquarters. Formalization reflects the extent to which rules and procedures determine interunit integration.

In this particular case of ICT knowledge transfers from the parent company to the subsidiary, the most important structural parameter to be considered is formalization. The goal of the mandatory ICT knowledge transfer and adoption is precisely to create an FSA in international coordination and control, which should be facilitated if supported by pre-existing written rules, standard operating procedures etc. To put it differently, in this particular case of mandatory ICT transfers, a 'global' orientation is likely the most effective. This leads to the hypothesis that:

H3: Higher formalization reinforces the positive impact of procedural justice perceived by the MNE subsidiary on effective ICT knowledge transfer and adoption.

Kogut and Zander (1993) introduced the knowledge attributes of codifiability, teachability, and complexity to measure the degree of knowledge tacitness. The less the knowledge can be codified, the harder it is to teach. Birkinshaw et al. (2002) added observability and system embeddedness as critical dimensions of knowledge transfer, and suggested that research take into account these factors when investigating the underlying knowledge characteristics. System embeddedness of knowledge is defined as the extent to which the knowledge is a function of the system or the context in which it is implemented. The sociology of technology argues that technological change can only be understood within the social context in which it is implemented, and should take into account explicitly the extent to which the physical location of a person's work affects knowledge (Feenburg, 1999; Latour, 1999; Pinch & Bijker, 1987). Here, technology reflects not only the values and objectives of the company but also the values and objectives of the people involved in the construction of this technology (Feenburg, 1999; Latour, 1999).

Procedural justice and absorptive capacity would be expected to become more important under conditions of higher levels of knowledge tacitness. When tacitness increases, the value of the knowledge

involved, from an ex ante perspective, becomes more uncertain and ambiguous. As a result, the knowledge transfer process will need to rely increasingly on procedural justice to be successful (Kim & Mauborgne, 1998). Increasing levels of knowledge tacitness involved in the ICT transfer would thus increase the importance of absorptive capacity and perceived procedural justice for the transfer and adoption to be effective. This leads to the hypothesis that:

H4: Higher tacit knowledge transfers reinforce the positive effects of absorptive capacity and procedural justice on effective ICT knowledge transfer and adoption.

From a normative perspective, the ultimate objectives to be achieved according to the hypotheses above are effective ICT knowledge transfer and adoption. From a managerial perspective, effective knowledge transfer and ICT adoption can be measured by the performance outcomes in usage which implicitly includes whether the knowledge transfer and ICT adoption processes have been effective. Positive performance outcomes in usage are necessary to obtain ‘clean’ and ‘seamless’ international knowledge transfer and ICT adoption. Alternatively, an unsatisfactory knowledge transfer and ICT adoption process will immediately translate into problematic performance in usage. This empirical work will therefore focus on various measures of performance outcomes in usage.

Performance outcomes in usage measures build upon the insights of Kim and Mauborgne (1996) and include the extent of extra-role behavior (voluntariness), in-role behavior, outcome satisfaction with the transfer, and commitment to support the transfer. Kim and Mauborgne (1996) found that inspired managers go beyond what is expected of them, and engage in a creative, innovative, and cooperative manner in implementing corporate headquarters’ decisions. The analysis was controlled for technology dependency and cultural distance. When enjoying greater autonomy, managers also have a greater degree of influence on decisions and therefore are more likely to show high commitment to implementing these decisions (Birkinshaw et al., 2002; Damanpour, 1991; Kostova & Roth, 2002; Russell, 1999).

Since our focus is on MNEs with operating subsidiaries in Canada, the country of origin of the parent organization can potentially have a significant effect on the proposed relationships. In this study, we followed the approach used by Jensen and Szulanski (2004) to measure cultural distance.

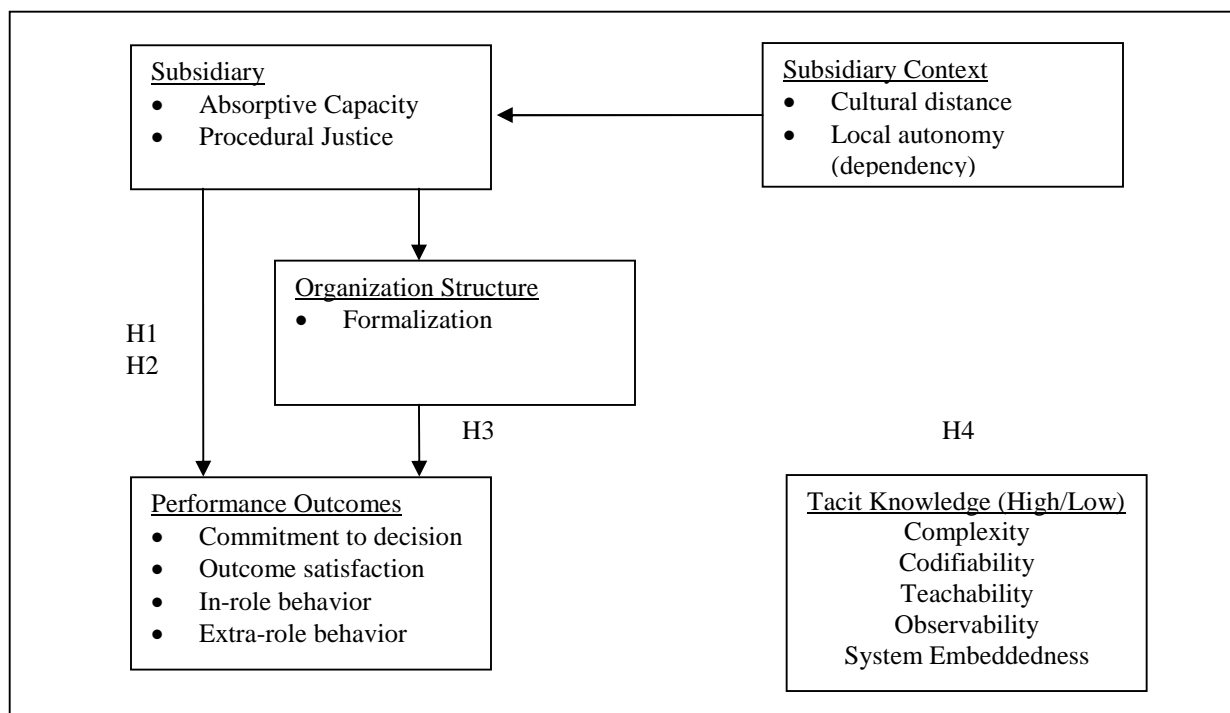


Figure 1 - Integrative Model of ICT Diffusion in the MNE Context

RESEARCH METHODOLOGY

We tested the hypotheses above as shown on figure 1 using data collected through a web based questionnaire completed using a key informant of the most senior individual responsible for ICT in the Canadian subsidiaries of foreign owned MNEs. We assumed these individuals would be the most knowledgeable about the effectiveness of ICT knowledge transfers from the parent company.

The sampling frame for the questionnaire survey was the population of Canadian subsidiaries of foreign owned MNEs. As found by Birkinshaw (1996), no definitive list exists of foreign subsidiaries in Canada, because most foreign-owned subsidiaries are owned directly by their parent companies. We created a subsidiary database using publicly available directories. We contacted by phone 731 Canadian subsidiaries to determine whether they had recently experienced an ICT project implementation mandated by the parent company and involving significant knowledge transfers from abroad with limited adaptation.

The criteria for an acceptable ICT transfer were determined as follows. First, it was preferred the system implementation to have been completed for at least one year - and no longer than five years - prior to the survey. This time period was chosen so the system had time to become routinized, but the memory of the entire implementation process would still be intact. Second, it was preferred the project value exceed \$100,000 CN. This minimum value was established to ensure the system was of significant strategic importance to the company.

We received 286 responses (39.1% response rate) of which 86 completed or partially completed the survey (11.8% completion rate). The key respondents adequately represented the senior person responsible for ICT with most having titles of CIO, Vice President, Director, or Manager. The responses represented eleven home countries of the parent organizations: US (53), Germany (6), Japan (6), UK (6), Switzerland (3), Hong Kong (2), France (2), Australia (1), Netherlands (1), Spain (1), Norway (1) and company name and country not reported (4). This distribution is consistent with the regional distribution of foreign direct investment stocks in Canada, with the United States still largely dominating these stocks.

An interesting side note is that 60 of the respondents (8.2%) indicated that all decision making and support for ICT resides with the parent company and there is no resources allocated in the Canadian subsidiary for ICT. At the opposite end of the spectrum, two of the respondents indicated the parent company had no involvement with decision making and support for ICT in the Canadian subsidiary.

The period of time since implementation as reported by 53 of the responses averaged 3.5 years and ranged from less than a year to ten years. The value of the ICT projects as reported by 45 of the respondents is shown in the adjacent table.

Number of Projects	ICT Project Value
10	< \$100,000
10	\$100,001 - \$250,000
6	\$250,001 - \$500,000
5	\$500,001 - \$1,000,000
8	\$1,000,001 - \$5,000,000
1	\$5,000,001 - \$10,000,000
5	> \$10,000,000

The questionnaire used a combination of scales used in prior studies with number of questions for each construct and the source of the measurement shown in Table 3. The constructs were measured using existing scales with wording adjusted to the specific research context. Questions utilized a 5-point Likert scale from 1=completely disagree to 5=completely agree.

Table 3 – Construct Sources

Construct	Construct Components	Source
Tacit knowledge attributes	<ul style="list-style-type: none"> • Complexity; 4 questions • Codifiability; 4 questions (RS 1,3,4) • Teachability; 5 questions (RS all) • Observability; 3 questions (RS all) • System Embeddedness; 6 questions 	Kogut and Zander (1992) Birkinshaw et al (2002)
Perceived procedural justice 5 questions	<ul style="list-style-type: none"> • Bilateral communications • Ability to challenge and refute • Local familiarity • Provision of a full account of strategic decision • Consistent non discriminate decision-making procedure across subsidiaries 	Kim and Mauborgne (1991)
Absorptive capacity 12 questions (RS 1)	<ul style="list-style-type: none"> ▪ Common language and vision ▪ Amount of information about the technology ▪ Roles, responsibilities and skills to implement the technology ▪ Technical and managerial competence to absorb the practice ▪ Network of who has information and can help problem solving 	Szulanski (1996) Boynton et al (1994)
Organizational structure	<ul style="list-style-type: none"> • Formalization; 8 questions (RS 1,2,5,8) • Decentralization; 6 questions 	Damanpour (1991)
Performance outcomes	<ul style="list-style-type: none"> • Outcome satisfaction; 2 questions (RS 1) • Commitment decision; 4 questions • In-role behavior; 3 questions • Extra-role behavior; 2 questions 	Kim and Mauborgne (1996) Sapienza & Korsgaard (1996)
Technology dependence 6 questions	<ul style="list-style-type: none"> • level of dependency of the subsidiary on the parent organization for technology support (scale 1= decided independently by subsidiary to 5= decided by parent company) 	Birkinshaw et al. (2002) Damanpour (1991) Kostova & Roth (2002) Russell (1999)
Cultural distance	<ul style="list-style-type: none"> • difference between home country and Canada (Kogut & Singh); cultural dimensions - power distance, individualism, uncertainty avoidance, and masculinity/femininity 	Jensen & Szulanski (2004) Hofstede (1983)
Legend	RS – reverse scored	

FINDINGS

The hypotheses were tested with regression analysis with a three-block model used to estimate the variance explained by the independent variables over and above that explained by the controls. The controls were entered in block 1, with either absorptive capacity or formalization entered in block 2, and the procedural justice variable entered into block 3. The complete model was run for each of the four dependent variables, i.e. the various indicators of performance outcome in usage. The logic for the particular sequence of entering variables is simply that the structural conditions of absorptive capacity and formalization were present in the subsidiary prior to the actual ICT transfer and the perceptions of procedural justice related to this specific ICT transfer.

DV/H	Commitment	Satisfaction	In-role	Extra-role
H1	NS	NS	NS	NS
H2	S (F Δ 12.878+)	S (F Δ 10.955**)	S (7.013*)	NS
H3	S (F Δ 2.940+)	S (F Δ 11.150**)	S (F Δ 8.278**)	NS
H4	NS	NS	NS	NS
Legend	PS-Partial Support	NS-not supported	S-Supported	
	AC - Absorptive capacity		PJ - Procedural justice	

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$

Table 2 - Summary of Hypotheses Analysis

Hypothesis 1 is not supported for any performance outcome variables, i.e. the presence of absorptive capacity did not have a significant effect on the effectiveness of ICT knowledge transfer and adoption on commitment, satisfaction, in-role behavior, and extra-role behavior. These findings are not consistent with our expectation that high absorptive capacity is associated with more effective transfer and adoption. Hypothesis 2 is supported with positive and significant results for performance outcome parameters: commitment, satisfaction, and in-role behavior, i.e. perceived procedural justice reinforces the effects of absorptive capacity. Hypothesis 3 is supported with positive and significant results for performance outcome parameters: commitment, satisfaction, and in-role behavior, i.e. the positive effects of perceived procedural justice are indeed strengthened by formalization, probably because formalization makes the ICT transfer process more transparent through the availability of proper documentation and well-understood routines.

To test for the effects of tacitness, the sample was split into two groups, i.e. ICT projects with high knowledge tacitness and ICT projects with low knowledge tacitness. Hypothesis 4 was not supported for any of the performance outcome parameters. In other words, in ICT transfers involving a higher tacit knowledge component, the effects of absorptive capacity and procedural justice had no significant effect on the effectiveness of ICT knowledge transfer and adoption. However, the models with formalization for all performance outcomes were significant and positive therefore organizations with a more formal organization structure work more effectively when ICT projects have high tacitness. However in the low tacitness group, the performance outcome parameters satisfy and in role behaviour were significant and positive for formalization with the significant effect from procedural justice. This result is probably since in a more formal organization when there is low tacitness the organization would rely on defined business processes that are already in the business unit's scope of work.

DISCUSSION AND CONCLUSIONS

The above results demonstrate that the effectiveness of ICT knowledge transfer and adoption is determined jointly by the subsidiary's absorptive capacity, and by perceptions of procedural justice for the ICT transfer considered. It would therefore appear important, in future work on international knowledge transfers, that the procedural justice concept, popularized in strategic and international management studies by Kim and Mauborgne (1991,1996 and 1998) be included systematically to assess knowledge transfer and adoption effectiveness. This implies that it is not sufficient to just address 'technical' issues in transfer processes. The MNE is also a social system, and especially in differentiated network MNEs, subsidiaries demand respect even when - and perhaps especially when - parent company ICT systems, meant to confer non-location bound FSAs to the MNE (Rugman, 1996), are imposed on them. We observe that for projects with high tacit knowledge the impacts of absorptive capacity and procedural justice are enhanced, whereas these parameters still have a positive but more limited effect in transfers involving lower levels of tacit knowledge.

This study is ongoing working at additional testing to examine the effect of differences in the home country of the parent organization and differences between industries through qualitative analysis from detailed open ended interviews with selected companies.

From a normative perspective, these results have important implications for the approach chosen by the parent company to diffuse and implement standardized ICT systems throughout the MNE's internal network. When ICT transfers involve more substantial bundles of tacit knowledge, and subsidiaries have a lower level of absorptive capacity, the parent company must invest more in the various components of procedural justice: more two way communication with subsidiaries, more attention devoted to consistent, non-discriminatory decision-making procedures across subsidiaries, more possibilities given to subsidiaries to voice concerns about parent company views, more explanation provided to subsidiaries on parent company decisions, and more investment in parent company managers familiarizing themselves with the subsidiaries' local situation. Obviously, the technology transfer mode itself can be instrumental in creating higher perceptions of procedural justice. Person-to-person and group-to-group teaching is an important social component in the knowledge transfer process and may be much more effective than direct transfers involving merely technical knowledge diffusion. Paradoxically, though national responsiveness may be lacking completely on the technical side, therefore efforts to increase perceptions of procedural justice may act as a valid and effective substitute.

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